NAU NORTHERN ARIZONA UNIVERSITY

College of the Environment, Forestry, and Natural Sciences

AST 580A: Techniques in Observational Astronomy

General Information

- Department: Astronomy and Planetary Science
- Course: AST 580A: Techniques in Observational Astronomy, Class Number 4672
- Term: Fall 2024
- Total Units of Course Credit: 1
- Pre- and Co-Requisite(s): Modern Physics and Graduate Status, AST 580 is co-req.
- Mode of Instruction: In-Person
- Meeting Time: Wednesday 2:20 - 4:50pm and designated observation time
- Location: Liberal Arts, Rm 214 and BLT

Instructor Information

- Instructor: Prof. Jasmine Garani
- Preferred Contact Method: Canvas Messaging, please allow 24 hours for a reply, messages received on the weekend or after 5pm on weekdays will be answered the following weekday
- Email: jasmine.garani@nau.edu
- Office Hours: Monday/Thursday 10-11am
- Office Location: Physical Sciences, Room 225 B
- Zoom office hours may be requested if needed

Course Purpose

This course will provide an introduction to the acquisition and reduction of modern astronomical data, emphasizing imaging, photometry, and the use of the IRAF software suite.

Course Objectives and Learning Outcomes

By the end of the class and laboratory, students will have a firm understanding of the skills necessary to plan, execute, reduce, and analyze data from a research-grade telescope and imaging system.

NACE Competencies

The National Association of Colleges and Employers (NACE) is a leading source of information on employment for the college educated. They identified eight Career Readiness Competencies (CRC) that are “a foundation from which to demonstrate requisite core competencies that broadly prepare the college educated for success in the workplace and lifelong career management.” More information can be found at https://www.naceweb.org/career-readiness/competencies/career-readiness-defined. The following are the CRCs that apply to this course.

1. **Communication**: Clearly and effectively exchange information, ideas, facts, and perspectives with persons inside and outside of an organization.
2. **Critical Thinking**: Identify and respond to needs based upon an understanding of situational context and logical analysis of relevant information.
3. **Professionalism**: Knowing work environments differ greatly, understand and demonstrate effective work habits, and act in the interest of the larger community and workplace.
4. **Teamwork**: Build and maintain collaborative relationships to work effectively toward common goals, while appreciating diverse viewpoints and shared responsibilities.
5. **Technology**: Understand and leverage technologies ethically to enhance efficiencies, complete tasks, and accomplish goals.

Assessment

Students WILL be assessed through the labs, homework, and the project.

Labs: Labs occur weekly in Liberal Arts 214. These labs will lead you through the use of IRAF (Image Reduction and Analysis Facility) such that by early-November, you will be able to reduce and analyze your observing project data. These labs are designed to be completed during the Wednesday afternoon class; but it is important to complete them properly and so all **labs will be due the following Wednesday at the start of class.** Note: Labs are cumulative in design and can not be skipped. They must be completed in order.

Observations: Students must make astronomical observations with the 0.5-meter Barry Lutz telescope during the semester as part of a 2-person team term project to produce a light curve of a WU Ma class contact binary star. The telescope is reserved on Wednesday nights for this purpose, but observing other nights of the week may be necessary.

Homework: One eyepiece observing homework will be assigned during the semester. It will be due at the end of the semester and consists of going to the BLT on one's own when it is open for eyepiece observing.

Quiz: There will be one short quiz before Lab 7 to assess knowledge gained so far.

Project: The project consists of reducing BLT data, analyzing the data, and producing a light curve. The end product will be a paper written to the standards of an astronomical journal. **Graduate students will also be required to present their project on the last day of class.**

Grading System

Your **Lab grade** will be calculated as follows:

Computer labs, Homework, Quiz will count for 50%
Going to and participating in your group's observing night will count for 10%
Final Project Paper and Presentation will count for 40%

Your **final grade** will be the same for both the class and the lab; calculated as 60%-class and 40%-lab.

A letter grade will be fixed at the end of the semester. An approximate grade scale is as follows:

A >= 90%
80% <= B < 90%
70% <= C < 80%
60% <= D < 70%
F < 60%

Grades will be kept up to date in Canvas. It is the student's responsibility to frequently check their scores in Canvas for accuracy. Any score in question must be discussed with me within two weeks of the due date. After two weeks, I will not entertain any challenges to the scores in Canvas.

Sometimes instructors make mistakes, and I am no exception: exams end up being harder than expected, or assignments are just too ambitious for the time available. In these (hopefully rare) cases, I reserve the right to modify the final course grades upwards. This modification is subject to the following policies: (1) the same modification will be applied to the grades of all students, and (2) the modification may never result in a lower grade, but always a higher one.

Makeup and Late Work

Students must obtain permission in advance of a regularly scheduled examination in order to take a make-up examination. An institutional excuse is required to get an extension from an online homework assignment. In addition, if unforeseen sickness occurs, please reach out to me and I will do my best to accommodate you in a reasonable manner. Points will be deducted from assignments at a rate of 10% for every day that they are late.

Administrative Drop

As a professor, I am required to administratively drop students from the course who do not participate in the first week of classes. To determine if you have participated in the first week, I will be checking both your Top Hat attendance and your Canvas activity. In order to not be dropped from the course please participate in Top Hat questions and access this course through Canvas during the first week of classes.

AI Statement

This course allows for the use of generative artificial intelligence (AI) technologies as part of the research and preparation phase of the work; for example, using these technologies to assist with research, generating ideas, creating summaries of topics, and developing drafts of text that are then used as an input to the work students do to generate a final assignment. In this use, students should be aware of the potential limitations of using generative AI as a tool for learning and research, since information is not always reliable or accurate, and should critically evaluate the sources, methods, and outputs of generative AI systems. Any final work submitted by students that contributes toward the course grade is expected to be generated by the students themselves, working individually or in groups as directed by class assignment instructions. Submitting final work created by generative AI constitutes an academic integrity violation. If you have any questions about this policy or if you are unsure whether a particular use of generative AI is acceptable, please ask for clarification before using such technologies.

Course Schedule (subject to change)

Week 1: Lab 1: Introduction to Linux
Week 2: Lab 2: Introduction to Iraf

Week 3: No Class, Flagstaff Astronomy Symposium
Week 4: Lab 3: More IRAF
Week 5: Lab 4: Bias and Dark Corrections
Week 6: Lab 5: Flat Field Corrections
Week 7: Lab 6: CCDProc
Week 8: Lab 7: Bias and Linearity
Week 9: Lab 8: Aperture Photometry
Week 10: Lab 9: Image Alignment and Making Pretty Pictures
Weeks 11-15: Work on Project

Academic Honesty

Please read this section carefully as each student is required to understand and comply with all Academic Integrity rules and standards. Both NAU and this Department/Course have standards which are written and referenced below.

Both myself and the science/engineering profession have absolutely no patience with cheating. Anyone cheating on an exam will receive a zero on that exam, and possibly a failing grade in the course. If anyone is caught using another student's account in Top Hat, both the students may receive a zero for the entire "in class questions" portion of the grade.

Note that no student will be allowed to exit the classroom during any of the exams, unless there is an emergency. Therefore, make sure you get a drink and visit the facilities in advance. If you feel that you might need to leave the classroom during an exam, you must get advance permission from the professor, in writing (email), before the exam. The use of cell phones at and time during an exam will be considered an act of academic dishonesty. The same holds true for smart-watches and "Google Glasses", or other enhanced vision products. You must not use or look at or touch your phone or watch (even if not a smart watch) at any time. You will be asked to place all such products securely away, out of reach and view, before the exam begins. You are not allowed to use your phone as a calculator. The same holds true for any calculator that can communicate with any other device or user. You may not bring in any paper to any exam, including "cheat sheets", and you may not take any paper out of the classroom after any exam. You are not allowed to look at the exam of another student, nor are you allowed to send or receive any information and/or signals or other forms of communication during an exam. The violation of any of these Academic codes of conduct may result in your failing the course.

In general, it is not my responsibility to attempt to describe and prohibit any and all forms of Academic Dishonesty. It is your responsibility to uphold the highest ethical standards. If you have any doubt or question about this policy, it is your responsibility to ask the professor in advance and to be clear about the answers and policies. Again, the text above and the attached NAU policies try to be very clear about what constitutes an act of Academic Dishonesty, but we cannot anticipate every possible form of cheating in advance. So the attachments and examples above are not meant to be comprehensive.

Academic Dishonesty information will be given to the Dean of Students and a written copy of any such incident may be attached to your official NAU file

Any student that has been found to be cheating will receive a 0 for the assignment in question.

Career Ready Resources

LinkedIn:

CEFNS Career Development www.linkedin.com/in/cefns-career-development-072715233

NAU Career Development https://www.linkedin.com/company/nau-career-development/

Handshake: https://nau.joinhandshake.com/login

Udemy: Online courses and career searching advice https://in.nau.edu/its/udemy/

Log in with your NAU email account and search 'NAU Career Steps'

O*net Online: Occupation exploration reports https://www.onetonline.org/

University Policies

ACADEMIC INTEGRITY

NAU expects every student to firmly adhere to a strong ethical code of academic integrity in all their scholarly pursuits. The primary attributes of academic integrity are honesty, trustworthiness, fairness, and responsibility. As a student, you are expected to submit original work while giving proper credit to other people's ideas or contributions. Acting with academic integrity means completing your assignments independently while truthfully acknowledging all sources of information, or collaboration with others when appropriate. When you submit your work, you are implicitly declaring that the work is your own. Academic integrity is expected not only during formal coursework, but in all your relationships or interactions that are connected to the educational enterprise. All forms of academic deceit such as plagiarism, cheating, collusion, falsification or fabrication of results or records, permitting your work to be submitted by another, or inappropriately recycling your own work from one class to another, constitute academic misconduct that may result in serious disciplinary consequences. All students and faculty members are responsible for reporting suspected instances of academic misconduct. All students are encouraged to complete NAU's online academic integrity workshop available in the E-Learning Center and should review the full *Academic Integrity* policy available at https://policy.nau.edu/policy/policy.aspx?num=100601.

COPYRIGHT INFRINGEMENT

All lectures and course materials, including but not limited to exams, quizzes, study outlines, and similar materials are protected by copyright. These materials may not be shared, uploaded, distributed, reproduced, or publicly displayed without the express written permission of NAU. Sharing materials on websites such as Course Hero, Chegg, or related websites is considered copyright infringement subject to United States Copyright Law and a violation of NAU Student Code of Conduct. For additional information on ABOR policies relating to course materials, please refer to ABOR Policy 6-908 A(2)(5).

COURSE TIME COMMITMENT

Pursuant to Arizona Board of Regents guidance (ABOR Policy 2-224, *Academic Credit*), each unit of credit requires a minimum of 45 hours of work by students, including but not limited to, class time, preparation, homework, and studying. For example, for a 3-credit course a student should expect to work at least 8.5 hours each week in a 16-week session and a minimum of 33 hours per week for a 3-credit course in a 4-week session.

DISRUPTIVE BEHAVIOR

Membership in NAU's academic community entails a special obligation to maintain class environments that are conductive to learning, whether instruction is taking place in the classroom, a laboratory or clinical setting, during course-related fieldwork, or online. Students have the obligation to engage in the educational process in a manner that does not interfere with normal class activities or violate the rights of others. Instructors have the authority and responsibility to address disruptive behavior that interferes with student learning, which can include the involuntary withdrawal of a student from a course with a grade of "W". For additional information, see NAU's *Disruptive Behavior in an Instructional Setting* policy at https://nau.edu/university-policy-library/disruptive-behavior.

NONDISCRIMINATION AND ANTI-HARASSMENT

NAU prohibits discrimination and harassment based on sex, gender, gender identity, race, color, age, national origin, religion, sexual orientation, disability, veteran status and genetic information. Certain consensual amorous or sexual relationships between faculty and students are also prohibited as set forth in the *Consensual Romantic and Sexual Relationships* policy. The Equity and Access Office (EAO) responds to complaints regarding discrimination and harassment that fall under NAU's *Nondiscrimination and Anti- Harassment* policy. EAO also assists with religious accommodations. For additional information about nondiscrimination or anti-harassment or to file a complaint, contact EAO located in Old Main (building 10), Room 113, PO Box 4083, Flagstaff, AZ 86011, or by phone at 928-523-3312 (TTY: 928-523-1006), fax at 928-523-9977, email at equityandaccess@nau.edu, or visit the EAO website at https://nau.edu/equity-and-access.

TITLE IX

Title IX of the Education Amendments of 1972, as amended, protects individuals from discrimination based on sex in any educational program or activity operated by recipients of federal financial assistance. In accordance with Title IX, Northern Arizona University prohibits discrimination based on sex or gender in all its programs or activities. Sex discrimination includes sexual harassment, sexual assault, relationship violence, and stalking. NAU does not discriminate on the basis of sex in the education programs or activities that it operates, including in admission and employment. NAU is committed to providing an environment free from discrimination based on sex or gender and provides a number of supportive measures that assist students, faculty, and staff.

One may direct inquiries concerning the application of Title IX to either or both the Title IX Coordinator or the U.S. Department of Education, Assistant Secretary, Office of Civil Rights. You may contact the Title IX Coordinator in the Office for the Resolution of Sexual Misconduct

by phone at 928-523-5434, by fax at 928-523-0640, or by email at titleix@nau.edu. In furtherance of its Title IX obligations, NAU promptly will investigate or equitably resolve all reports of sex or gender-based discrimination, harassment, or sexual misconduct and will eliminate any hostile environment as defined by law. The Office for the Resolution of Sexual Misconduct (ORSM): Title IX Institutional Compliance, Prevention & Response addresses matters that fall under the university's Sexual Misconduct policy. Additional important information and related resources, including how to request immediate help or confidential support following an act of sexual violence, is available at https://in.nau.edu/title-ix.

ACCESSIBILITY

Professional disability specialists are available at Disability Resources to facilitate a range of academic support services and accommodations for students with disabilities. If you have a documented disability, you can request assistance by contacting Disability Resources at 928-523-8773 (voice), ,928-523-8747 (fax), or dr@nau.edu (e-mail). Once eligibility has been determined, students register with Disability Resources every semester to activate their approved accommodations. Although a student may request an accommodation at any time, it is best to initiate the application process at least four weeks before a student wishes to receive an accommodation. Students may begin the accommodation process by submitting a self-identification form online at https://nau.edu/disability-resources/student-eligibility-process or by contacting Disability Resources. The Director of Disability Resources, Jamie Axelrod, serves as NAU's Americans with Disabilities Act Coordinator and Section 504 Compliance Officer. He can be reached at jamie.axelrod@nau.edu.

RESPONSIBLE CONDUCT OF RESEARCH

Students who engage in research at NAU must receive appropriate Responsible Conduct of Research (RCR) training. This instruction is designed to help ensure proper awareness and application of well-established professional norms and ethical principles related to the performance of all scientific research activities. More information regarding RCR training is available at https://nau.edu/research/compliance/research-integrity.

MISCONDUCT IN RESEARCH

As noted, NAU expects every student to firmly adhere to a strong code of academic integrity in all their scholarly pursuits. This includes avoiding fabrication, falsification, or plagiarism when conducting research or reporting research results. Engaging in research misconduct may result in serious disciplinary consequences. Students must also report any suspected or actual instances of research misconduct of which they become aware. Allegations of research misconduct should be reported to your instructor or the University's Research Integrity Officer, Dr. David Faguy, who can be reached at david.faguy@nau.edu or 928-523-6117. More information about misconduct in research is available at https://nau.edu/university-policy-library/misconduct-in-research.

SENSITIVE COURSE MATERIALS

University education aims to expand student understanding and awareness. Thus, it necessarily involves engagement with a wide range of information, ideas, and creative representations. In their college studies, students can expect to encounter and to critically

appraise materials that may differ from and perhaps challenge familiar understandings, ideas, and beliefs. Students are encouraged to discuss these matters with faculty.